

REMARKS

This responds to the Office Action mailed on April 17, 2006. By this amendment, claims 3, 25, 39 and 40 were amended to overcome the Examiner's objection to the claims due to the below listed informalities. No claims were canceled, or added. As a result, claims 1-13, 21-27, 31-33 and 35-40 remain pending in this application. Reconsideration of this application in view of the following remarks is requested.

Interview Summary

Applicant thanks Examiner Colleen E Rodgers for the courtesy of a telephone interview on April 4, 2006 with Applicant's representative Richard E. Billion. The Examiner agreed to remove the finality of this office action but needed to acquire approval from her supervisor.

On September 18, 2006, the Examiner and Applicant's representative conducted another interview regarding to the status of the last interview. According to the examiner, she had discussed the case with her supervisor and was not able to gain the approval from her supervisor. As a result, the case remains finally rejected.

Objection of the Claims

A. Objection: In the Office Action of April 17, 2006, the Examiner objected to claims 3, 25, 39, and 40 because of the following informalities:

Regarding claim 3, change the dependency from claim 3 to claim 2.

Regarding claim 25, remove the comma between "interfacial adhesion layer" and "results in interdiffusion" in line 2.

Regarding claim 39, change the dependency from claim 31 to claim 38.

Regarding claim 40, change the dependency from claim 31 to claim 38.

B. Response: In this response, Applicant has made the changes suggested by the Examiner. As a result, the Examiner's objections are now overcome.

§102 Rejection of the Claims

A. Rejection: Claims 1, 4, and 11-13 were rejected under 35 USC § 102(e) as being anticipated by Kailasam (U.S. 2005/0181598).

B. Response: Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration. *In re Dillon* 919 F.2d 688, 16 USPQ 2d 1897, 1908 (Fed. Cir. 1990) (en banc), cert. denied, 500 U.S. 904 (1991). It is not enough, however, that the prior art reference discloses all the claimed elements in isolation. Rather, anticipation requires the presence in a single prior reference disclosure of each and every element of the claimed invention, *arranged as in the claim.*” *Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 221 USPQ 481, 485 (Fed. Cir. 1984) (citing *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 220 USPQ 193 (Fed. Cir. 1983)) (emphasis added).

Claim 1 recites “...making a via opening having a base, the base of the via opening positioned at a selected level that includes a first conductive material within the integrated circuit packaging substrate; depositing an interfacial layer material within at the base of opening; placing a second conductive material over the interfacial material; and directing energy to the base of the opening to heat the materials at the base of the opening.” Kailasam fails to teach several of the elements of this claim. The Kailasam reference is directed toward the adhesion of a plateable barrier/seed layer to adjoining dielectric layers. Kailasam states that “This invention describes a method to enable the adhesion of ruthenium, a candidate for directly plateable barrier/seed layer, to adjoining dielectric materials.” (See paragraph [0031] of Kailasam) Kailasam goes on to state that “The introduction of an ultra-thin adhesion layer to improve the adhesion of the plateable barrier materials to the dielectric is proposed.” (See paragraph [0032] of Kailasam) Therefore Kailasam is directed at adhering a plateable barrier/seed layer to the dielectric material. The dielectric material acts as an insulator. Therefore, Kailasam reference is not for connecting a first conductive material to a second conductive material. As a result, Kailasam fails to teach both the first conductive material and the second conductive material as recited in the claim. As a result, Kailasam fails to teach the elements of making a via opening having a base, the base of the via opening positioned at a selected level that includes a first

conductive material within the integrated circuit packaging substrate, and placing a second conductive material over the interfacial material.

Furthermore, as mentioned in the previous response, dated January 31, 2006, Kailasam teaches a general heat treatment not directed toward a the base of the opening. Kailasam teaches that the“...wafer is then heated and exposed to a precursor 56 to form the desired adhesion layer of boron, carbon, silicon, titanium nitride, or tantalum nitride.” (See paragraph 40 of Kailasam). As a result, applicant respectfully submits that Kailasam fails to teach directing energy to the base of the opening to heat the materials at the base of the opening, as recited in claim 1. Placing an entire wafer in an oven or wafer chamber is not directing energy to the base of the opening. There is no directing of energy other than to the entire wafer. Since Kailasam fails to disclose each element of the claim under consideration, the Examiner has failed to make a proper *prima facie* case of anticipation. Accordingly, claim 1 now overcomes the rejection under 35 USC § 102(e) as being anticipated by Kailasam et al. (U.S. 2005/0181598).

Claims 4 and 11-13 depend from claim 1 and include the recitations of claim 1 by their dependency. Accordingly, claims 4 and 11-13 now also overcome the rejection under 35 USC § 102(e) as being anticipated by Kailasam et al. (U.S. 2005/0181598).

§103 Rejection of the Claims

A. Rejection: Claims 2 and 3 were rejected under 35 USC § 103(a) as being unpatentable over Kailasam et al. (U.S. 2005/0181598) in view of Cohen et al. (U.S. 2005/0215046 A1).

B. Response: In order for the Examiner to establish a *prima facie* case of obviousness, three base criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference or references must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on

applicants disclosure. *M.P.E.P.* § 2142 (citing *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed.Cir. 1991)).

Claims 2 and 3 depend from claim 1 and include the recitations of claim 1 by their dependency. Claim 1 recites “...making a via opening having a base, the base of the via opening positioned at a selected level that includes a first conductive material within the integrated circuit packaging substrate; depositing an interfacial layer material within at the base of opening; placing a second conductive material over the interfacial material; and directing energy to the base of the opening to heat the materials at the base of the opening.” The combination of Kailasam et al. and Cohen et al. fails to set forth a proper *prima facie* case of obviousness. Kailasam fails to teach or suggest both the first conductive material and the second conductive material as recited in the claim. Kailasam et al. is directed toward bonding to a dielectric layer rather than a first conductive layer. The Cohen et al. reference also does not appear to teach or suggest bonding between a first conductive layer and a second conductive layer. As a result, the combination of Kailasam et al. and Cohen et al. fails to teach or suggest the elements of making a via opening having a base, the base of the via opening positioned at a selected level that includes a first conductive material within the integrated circuit packaging substrate, and placing a second conductive material over the interfacial material. The references do not teach or suggest all the claim limitations.

In addition, Kailasam fails to teach or suggest the element of directing energy to the base of the opening to heat the materials at the base of the opening, as recited in claim 1. Kailasam discloses a general heat treatment not directed toward the base of the opening. Kailasam discloses that the “...wafer is then heated and exposed to a precursor 56 to form the desired adhesion layer of boron, carbon, silicon, titanium nitride, or tantalum nitride.” (See paragraph 40 of Kailasam). Cohen et al. also fails to teach or suggest this element. Since neither Cohen et al. nor Kailasam teach or suggest all the claim limitations, the Examiner’s case is not a proper *prima facie* case of obviousness. Accordingly, claims 2 and 3 now overcome the rejection under 35 USC § 103(a) as being unpatentable over Kailasam et al. (U.S. 2005/0181598) in view of Cohen et al. (U.S. 2005/0215046 A1).

C. Rejection: Claims 5 and 6 were rejected under 35 USC § 103(a) as being unpatentable over Kailasam (U.S. 2005/0181598) in view of Chan et al. (U.S. 6,495,200 B1).

D. Response: In order for the Examiner to establish a *prima facie* case of obviousness, three base criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference or references must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *M.P.E.P.* § 2142 (citing *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed.Cir. 1991)).

Claims 5 and 6 depend from claim 1 and include the recitations of claim 1 by their dependency. Claim 1, as amended, recites "...directing energy to the base of the opening to heat the materials at the base of the opening." Chan et al. fails to teach or suggest this element. Chan et al. discloses a general heat treatment to a layer of material, such as the thermal treatment of layer 17A (See element 203 of FIG. 3 of Chan et al.), rather than directing energy to the base of the opening to heat the materials at the base of the opening. Even if the opening in Chan et al. was considered a via, Chan et al. does not direct energy at the base of the opening. Rather Chan et al. also discloses heating one layer at the top of the opening. The layer of interest is referred to forming a passivation layer over the Cu plug (see bottom of Col. 4 and top of Col. 5 of the Chan et al. reference). Chan et al. also discloses heating one material rather than "...the materials at the base of the opening" as recited in claim 1 (note the emphasis on materials being plural). In Chan et al. only the seedling layer is heated (See column 4, lines 30-35 of Chan et al.). As mentioned above, the Kailasam et al. reference also fails to teach or suggest the element of directing energy to the base of the opening. Kailasam places a wafer in the chamber which is the same as placing something in the oven. There is no direction of the energy to any particular area of the item. Since neither Chan et al. nor Kailasam et al. teach or suggest all the claim limitations, the Examiner's case is not a proper *prima facie* case of obviousness. Accordingly,

claims 2 and 3 now overcomes the rejection under 35 USC § 103(a) as being unpatentable over Kailasam (U.S. 2005/0181598) in view of Chan et al. (U.S. 6,495,200 B1).

Allowable Subject Matter

Claims 7-10, 21-27, 31-33, and 35-40 were allowed. Applicant notes the allowance of claims 7-10, 21-27, 31-33, and 35-40 with appreciation.

Conclusion

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at (612) 373-6977 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

KUM FOO LEONG ET AL.

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9/18/06

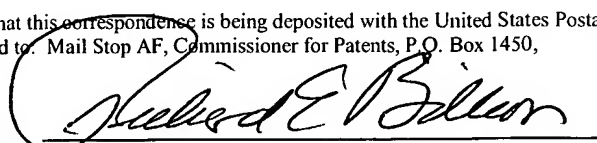
By



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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Mail Stop AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 18 day of September, 2006.

RICHARD E. BILLION



Name

Signature